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BULLETIN NO. 13. - - - - NEW SERIES.

# Agricultural Experiment Station,

OF THE

# Agricultural and Mechanical College,

AUBURN, ALA. - - - - MARCH, 1890.

## Microscopic Study of Certain Varieties of Cotton.

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SYNOPSIS.

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## A MICROSCOPIC STUDY OF THE COTTON PLANT.

P. H. MELL, BOTANIST

### I. Species and Varieties.

There are several species of the cotton known to botanists but only three are of special commercial importance. These three are called:

*Gossypium Bahma*, or Egyptian cotton.

*Gossypium barbadense*, or *G. nigrum*, or Sea Island cotton, or long staple or black seed cotton.

*Gossypium herbaceum*, or *G. album*, or short staple, or upland or green seed cotton.

Monsieur Rohn also divides the species into—

1. Those with seeds rough and black.
2. Those with seeds brownish black and veined.
3. Those with seeds sprinkled with short hairs.
4. Those with seeds completely covered with close down.

The three species, above mentioned, have been multiplied into twenty or thirty so-called *varieties*, by certain kinds of cultivation and careful selecting in the hands of progressive planters. Some of these varieties are very good and worthy consideration, while others have no right to a new name.

*G. Bahma* originated in Egypt some years since, and is supposed to be a hybrid, made with a species of the Hibiscus and the native Egyptian cotton plant. The fibre of this plant is inferior in several respects to that produced by G. herbaceum, that furnishes more than nine-tenths of the staple of commerce. The Sea Island, or as it was formerly called in Georgia, "Persian cotton," requires a salt atmos-

phere, and is, therefore, confined to limited areas. Its largest production is made along the coasts of South Carolina, Georgia and Florida. The staple is also limited in its application, since it is mainly used in the manufacture of lace.

## II. What is Cotton Fibre?

When cotton is first taken from the boll it consists of seed with the germ surrounded by its food, a coating or covering called by oil manufacturers the "hull," and by botanists, outer and inner seed-coats, and an outside envelop of elongated threads or tubes that are attached to the outer seed-coat. These threads are, in fact, simply elongated cells of this coat. These cells cover thickly the whole surface of the seed, and in ginning it is necessary to tear them off by rupture at the portion near the seed coat. Seeds are cleanly ginned in proportion to the distance from the surface reached by the cutting edges of the teeth of the ginning saws. The thread or fibre in its young state is cylindrical, but upon maturing and becoming dry it collapses and assumes a more or less flat, ribbon-like, twisted form. The degree of twist given the fibre, its regularity in diameter and length determine the value of the cotton in the markets of New York and Liverpool.

## III. List of Varieties Tested and Results Obtained.

During the past two seasons I obtained from the farm of the Experiment Station, a number of samples of cotton, representing eighteen varieties, two selected specimens from Savannah, Georgia, of the Sea Island cotton and a sample of the "Bailey" fibre from North Carolina. Careful studies have been made of these specimens under high powers of the microscope, and a number of interesting results were obtained. The following are some of the questions considered by me during these investigation:

1. How many real varieties of cotton exist?
2. In forcing the plant under high cultivation is the fibre improved, or is simply the "weed" enlarged to the detriment of the staple? Is it not often the case that the fruit of the cotton plant is damaged by too rapid maturing, just as the fruit of the peach is known to be immature at the centre in some early forced varieties?
3. The effect produced on the fibre when caught by frost just as the boll opens?

4. At what stage of the growth and maturity of the boll does the fibre attain its full development?

The last two questions will not be considered in this bulletin, because my investigations have not been carried far enough to warrant the publication of conclusions on those points. I intend to present them in some future bulletin.

The following are the names of the varieties that were subjected to the tests:

*Gossypium herbaceum*—

1. Peerless—permitted to degenerate, not fertilized.
2. Peerless—permitted to degenerate, fertilized with floats; blighted.
3. Peerless—permitted to degenerate, not fertilized, not blighted.
4. Peerless—permitted to degenerate, fertilized with floats and cotton-seed meal.
5. Peerless—permitted to degenerate, fertilized with floats and cotton-seed meal; blighted.
6. "Peerless"—fertilized with compost broad-cast, 1,000 pounds to the acre, composed of the proportions, 500 pounds cotton-seed meal, 500 pounds acid phosphate, and 1,000 pounds stable manure.
7. "Welborn's Pet"—fetilized like No. 6.
8. "Truitt"—fertilized like No. 6.
9. "Rameses"—fertilized like No. 6.
10. "Cherry's cluster"—fertilized like No. 6.
11. "Okra leaf cotton"—fertilized like No. 6.
12. "Hawkins' improved."
13. "Allen's long staple."
14. "Jones' improved."
15. Georgia ordinary upland, obtained from W. W. Gordon & Co., Savannah, Ga.
16. "Peterkin."
17. "Southern hope."
18. "Zellner."
19. "Barnett's short staple."
20. "King's improved prolific."
21. "Ellsworth."
22. "Bailey," (doubtfully placed under herbaceum.)
23. Sample obtained from Mr. W. N. Brandon, of Coffee Springs, Alabama; name of variety unknown.

*Gossypium barbadense, or nigrum*—

24. Sea Island No. 1, obtained from Mr. P. D. Duffin, commission merchant of Savannah, Georgia.
25. Sea Island No. 2. Obtained from W. W. Gordon & Co., commission merchants of Savannah, Georgia.

Many experiments were made on each one of the above

samples to determine the diameter and regularity of fibre, the average length of the strands, the character of twist and the internal structure. Also several strands were selected at random from the bolls and the strain necessary to break them carefully determined by fastening one end of the fibre and weighting down the other until rupture was produced.

Sample number 1 was a poor grade of cotton that was obtained from stalks about ten to twelve inches high, growing on sandy soil unfertilized. Four tests of the strength were made with two strands in each test with the following results: 1st, Broke under a strain of 9.498 grammes; 2nd, 19.057 grammes; 3rd, 21.404 grammes; 4th, 11.635 grammes. Average for two strands 15.398 grammes (1 gramme is equivalent to 15.43 grains). Length of fibre 1st test, 22 4 millimeters (1 millimeter is equivalent to 0.039 of an inch); 2nd test, 24 millimeters; 3rd test, 23.2 millimeters; 4th test, 24.8 millimeters. Average length of fibre, 23.6 millimeters. The diameter ranged from 0.009 millimeters to 0.016 millimeters. These results indicate a lack of uniformity. When the fibres were placed under the microscope it was noticed that some were immature, some were only slightly twisted, while others, though well twisted, were small and weak.

Number 2 was obtained from the same field but from a plat that had been fertilized with floats. The stalk was small and badly blighted, but the fibre was about the same grade with number 1. The grade of both plants is so low in the scale, the injury to the fibre may be due largely to immature growth in the plant before the blight obtained headway. However, this is difficult to determine with these samples, as they were obtained so late in the season.

Number 3 was also obtained from the same field and the same plat from which No. 1 was drawn. The plant was not blighted, but the stalk was small. In the first test upon the strength of two strands the fibre broke under a load of 27 475 grammes; 2nd, 33.915 grammes; 3rd, 29.000 grammes; 4th, 45.176 grammes. Average for two strands, 33.891 grammes. Length of fibre 1st test, 25.6 millimeters; 2nd test, 20 millimeters; 3rd test, 23.2 millimeters; 4th test, 22.4 millimeters. Average length, 22.8 millimeters. Diameter of fibre, 0.016 millimeters. This is an improvement

over the two preceding. The twist of the fibre is an average, but there was a good deal of waste in the boll.

Number 4 was obtained from the same plat that No. 2 came from, but was not blighted. Rupture: 29.151, 23.652, 21.061, 26.719 grammes. Average for two stands, 25.145 grammes. Length of fibre, 17.6, 21.6, 21.6, 21.6 millimeters; average length, 20.6 millimeters; diameter, 0.016 millimeters. The twist was medium. The resistance to rupture was more uniform than the preceding and the staple was a better grade.

Number 5 was another specimen of blighted cotton from the same field in the plat fertilized with floats and cotton seed meal. The fibre was quite imperfect in development, and the twist was inferior. Resistance to rupture: 13.990, 5.620, 11.237, 13.000 grammes. Average resistance, 10.962 grammes. Average length of fibre, 20.2 millimeters; diameter, 0.024 millimeters.

Number 6 represents the variety Peerless. The stalk was large, well developed and loaded with fruit. The field in which the plant grew was fertilized with compost, 200 pounds cotton seed meal and 200 pounds acid phosphate, 1,000 pounds to the acre. The diameter of fibre was 0.016 to 0.024 millimeters, the last measure predominating. The twist was about an average and the length ranged from 18 millimeters to 20.8 millimeters. Average 18.5 millimeters. The resistance to rupture: 23.142, 20.552, 23.044, 11.623 grammes. Average 20.840 grammes. This is a good grade of cotton, with even texture and uniform diameter.

Number 7, or Welborn's Pet, was fertilized in the same manner that was used with No. 6. The plant was large, well fruited and apparently healthy. Diameter of fibre, 0.016 to 0.024 millimeters. Length: 21.6, 23.2, 21.2, 22.4 millimeters. Average 22.1 millimeters. Resistance to rupture: 12.258, 15.850, 15.902, 11.430 grammes; average, 3.860 grammes. Twist of fibre average. The grade of this cotton is below that of the Peerless, because the fibres were irregular in diameter, yielding weak places in the strands.

Number 8, or Truitt, from the same field with the last and fertilized in the same manner. The plant was well grown and well fruited. Diameter of fibre, 0.016 to 0.024 millimeters. Twist excellent. Length, 22.4, 22, 21.4, 21.6;

average 21.8 millimeters. Resistance to rupture: 35.437, 28.472, 36.856, 20.525 grammes; average, 30.322 grammes. The strength of the fibre is high and the grade of the cotton excellent.

Number 9, Rameses, fertilized in the same manner as No. 6. Plant was well grown and heavily fruited. Diameter of fibre 0.019 to 0.024 millimeters. Length: 20.8, 17.6, 21, 20.8 millimeters; average, 20.1 millimeters. Twist excellent. Resistance to rupture: 25.566, 28.702, 29.212, 25.558 grammes; average, 26.758 grammes. The staple was of uniform strength and uniform diameter.

Number 10, Cherry's Cluster, same fertilization. Plant in good condition and well fruited. Diameter of fibre, 0.019 to 0.027 millimeters. Twist excellent. Length: 23.2, 22.4, 23.2, 20.8 millimeters; average, 22.4 millimeters. Resistance to rupture: 35.216, 18.695, 38.690, 25.310 grammes; average, 29.477 grammes.

Number 11, Okra or Forked Leaf, same fertilization. Plant in good condition and well fruited. Diameter of fibre, 0.016 to 0.027 millimeters. The last measuremen, predominated. The twist was poor. Length: 31.2, 33.6 28.8, 28 millimeters; average, 30.4 millimeters. Resistance to rupture: 17.933, 18.470, 10.471, 10.088 grammes; average, 14.240 grammes. The strength of this variety is not as great as the last by one-half. This was due to the fact that the twist was poor and the diameter was not the same throughout the length of the fibre, and the weak points quickly yielded to the strain applied.

Number 12, Hawkins improved, fertilized with cotton seed meal and acid phosphate, 200 pounds to the acre. Diameter of fibre, 0.008 to 0.016 millimeters. Twist poor. Length. 19.2, 16, 18.4, 16.8 millimeters; average, 17.6 millimeters; Resistance to rupture: 12.446, 2.991, 10.710, 8.333 grammes: average 8.620 grammes. These results indicate an inferior condition of the cotton. The fibres were irregular in diameter with weak points, and a number of strands on the seeds were immature in development.

Number 13, Allen's long staple, fertilized in the same way that was used with Hawkins'. Diameter of fibre, 0.016 to 0.024 grammes. Twist inferior. Length: 26.4, 25.6, 26.4,

27.2 millimeters; average, 26.4 millimeters. Resistance to rupture: 17.353, 14.539, 15.516, 23.975 grammes; average, 17.845 grammes. The fibre of this variety was more mature and even in diameter, although the twist was inferior, hence it withstood the strain quite well. But the grade can be considerably improved.

Number 14, Jones' improved, fertilized like Hawkins'. Diameter of fibre, 0.016 to 0.024 millimeters. Twist medium. Length: 22.4, 22.4, 23.2, 23.2 millimeters; average, 22.8 millimeters. Resistance to rupture: 23.083, 15.323, 25.448, 20.900 grammes; average, 23.338 grammes. The grade of this cotton is an improvement over the last.

Number 15, Zellner, fertilized the same way. Diameter of fibre, 0.016 to 0.020 millimeters. Twist good. Length: 21.6, 21.6, 23.2, 23.2; average, 22.4 millimeters. Resistance to rupture: 20.130, 28.106, 26.345, 15.614 grammes; average, 22.556 grammes. This is also a good grade of cotton.

Number 16, Barnett's short staple, fertilized in the same way. Diameter of fibre, 0.016 to 0.028 millimeters. Twist poor. Length: 22.8, 24.2, 23.2, 24.8 millimeters; average, 24.8 millimeters. Resistance to rupture: 10.960, 10.370, 12.050, 8.363 grammes; average, 10.436 grammes. The fibre was so weak it was difficult to handle without breaking. The strands were immature in development.

Number 17, King's improved, fertilized in the same way. Diameter of fibre, 0.012 to 0.016 millemeters. Twist good. Length: 17.6, 20, 15.6, 20 millimeters; average, 18.3 millimeters. Resistance to rupture: 15.720, 12.996, 16.490, 18.100 grammes; average, 15.826 grammes. Although the average resistance is low, still the strands were of uniform strength, and with higher fertilization, the plant may be made to produce excellent cotton.

Number 18, Ellsworth fertilized in the same way. Diameter of fibre, 0.012 to 0.024 millimeters. Twist good. Length, 21.6, 21.6, 21.2, 1.20 millimeters; average, 21.1 millimeters. Resistance to rupture, 20.330, 22.050, 20.685, 20.838 grammes; average, 20.976 grammes.

Number 19, Georgia ordinary upland. Sent to me by W. W. Gordon & Co., commission merchants of Savannah, Ga. Character of fertilizer not known. The fibre was re-

ceived in a ginned condition and the number of seed to boll and weight of staple could not be determined. Diameter of fibre, 0.012, to 0.016 millimeters. Twist medium. Length of fibre could not be accurately determined, because the cotton was sent to me ginned. Resistance to rupture, 19.038, 17.597, 21.965, 13.650 grammes; average, 18.083 grammes.

Number 20, Peterkin. Obtained from farm of Experiment Station. Character of fertilization—1,000 lbs. compost per acre, in the drill. Diameter of fibre, 0.008 to 0.016 millimeters. Twist medium. Length, 22, 25.2, 23.2, 22.4 millimeters; average, 23.2 millemeter. Resistance to rupture, 20.757, 14.438, 11.490, 20.649 grammes; average, 16.834 grammes.

Number 21, Southern hope. Fertilized like Peterkin. Diameter of fibre, 0.016 to 0.020 millimeters. Twist good. Length, 27.2, 23.2, 23.2, 24 millimeters; average, 24.4 millimeters. Resistance to rupture, 13.363, 21.453, 29.903, 22.928 grammes; average, 21.912.

Number 22, Bailey. Obtained from the Bailey Cotton Co. of Raleigh, N. C. The sample was ginned, and hence, lengths of strand, number of seed to boll and weight of fibre were not determined. Diameter of fibre, 0.019 millimeters. Twist poor. Resistance to rupture, 18.683, 15.413, 12.066, 18.687 grammes; average, 16.212.

Number 23, sample obtained from Mr. W. N. Brandon of Coffee Springs, Alabama. The name of the variety was not furnished me, but the plants were thrifty and healthy and averaged three feet in height; well fruited. The fertilizer used was 1,200 pounds to acre of stable manure, with pine straw and leaves, and 125 lbs. of guano to acre in the furrows before bedding and 75 pounds to acre about the last of May. Diameter of fibre, 0.024 millimeter. Twist medium. Length of strands, 21.6, 16.8, 19.2, 20.8 millimeters; average, 19.6, millimeters. Resistance to rupture; 14.303, 24.556, 25.173, 17.500 grammes; average, 20.383 grammes.

Number 24. Sea Island No. 1, obtained from P. D. Duffin, commission merchant, Savannah, Georgia. Diameter of fibre, 0.016 millimeters. Twist average, with weak places. Length averages 37 millimeters, but this is only approximate, as the sample sent me was ginned. Resistance to rupture; 16.462, 23.726, 16.968, 9.606 grammes; average, 18.602 grammes.

Number 25. Sea Island No. 2, obtained from W. W. Gordon & Co., commission merchants of Savannah, Georgia. Mr. Gordon States that this sample is not genuine Sea Island, but that its quality has been somewhat changed by growing the plant in the interior of Florida. The cotton was ginned and the length, 48. millimeters, can only be approximate. The fibre was slightly stained with adhering particles of dust. Diameter; 0.016 to 0.024 millimeters. Resistance to rupture; 17.447, 12.156, 14.356, 7,506 grammes; average, 15.578 grammes.

It seems evident from the foregoing, that it is not always the large plant that produces the best condition of the fibre. Experiment seems to determine that the most excellent condition of the fibre is produced only on those plants that are healthy in all their functions, neither too rapid nor slow in their development, and that are given all the advantages of judicious cultivation with the proper fertilization and under the most favorable conditions of the atmosphere. In improving the grade of cotton, the following must also be carefully noted. The plant must be forced to produce fibre, that is—

1. Long, and as nearly as possible, uniform in length.
2. Of uniform diameter throughout.
3. Flat and ribbon-like, and well twisted.

The cells must not collapse until well matured, so that the collapsing and twisting will occur with equal intensity throughout the entire length of the tube.

I will state as a proposition: No plant has a right to a new name unless it is able to produce fibre closely approaching the above conditions. The cultivation of cotton is chiefly for the staple it produces, and every effort should be made to improve its quality.

Now, in order to secure the results desired, it is necessary to consider the following important steps:

1. The improvement of the seed.
2. The character of the soil.
3. The best kind of fertilizer.
4. The best method of cultivation.
5. The conditions of the weather most favorable.

### 1. The Improvement of the Seed.

The seed is the beginning of the new plant, and contains

within itself all the future possibilties of the full developed plant it will produce. There is an old expression that what the child is, so will be the man. This is as true of the vegetable as of the animal kingdom. Imperfect seed must produce imperfect plants. The intelligent farmer has often noticed in his fields of cotton, some plants much larger than others, containing a larger number of well-formed bolls, and with fibre whiter, more silky, and better in quality than on any other plant in the field. If he would select from this plant the bolls that are the largest, the finest and most perfectly matured; and after ginning the cotton carefully select the seed, rejecting all that are blasted or imperfectly shaped; and then carefully protect them to prevent fermentation or becoming in any manner damaged until the next planting season, the first important step would be taken. There is no chance in this matter, if we follow closely the laws by which nature performs her perfect work. The cotton seeds that have thus been carefully collected from the first plant must be placed in the best prepared soil, under the best conditions and well cultivated. No cotton of an inferior grade must be planted in the immediate neighborhood. In fact, it does not pay to cultivate inferior cotton, and it is best to send all such seeds to the oil mills. When blooms of low grade cotton open, insects and winds will soon transport the pollen from them to the pistils of the selected variety and the germs will become depreciated by such inferior fertilization. There are a number of insects that visit the flowers of the cotton plant for the nectar they contain; and in the effort to reach the base of the flower where the nectar is found, their bodies become covered with pollen that is transferred to the stigma where they come in contact with pistils of other flowers. It is readily seen, therefore, that if plants of an inferior grade are growing and blooming in the immediate neighborhood of the selected varieties, the insects will soon convey the pollen from the inferior to the superior plant, and the seed that will be produced will contain a germ with qualities of the inferior plant. This work of the insects might explain to some extent why it is that improved seeds in a few years degenerate so badly. If the selection of the seed is re-

peated from year to year, and no inferior cotton planted near enough to vitiate with its pollen by means of insects or wind, and if seasons are favorable, there seems to be no reason why practically perfect plants may not be produced.

2. The Character of the Soil.

It goes without saying that a soil in the first place must contain those mineral elements of plant food in a most available form that the cotton necessarily requires for its full development and maturity. This information is obtained by a chemical analysis of the plant with all its products and a careful examination of the soil by means of tests made with the growing plant and fertilizers now so well understood by most intelligent farmers.

Besides the ingredients comprising the soil it should have certain physical properties, without which it would be wholly inadequate for the purposes of producing well matured plants. It should have the power to absorb and retain moisture, so that in times of drought, in August and September, when seed and fibre are to be formed, and when diminished leaf activity is desirable, the soil should have sufficient moisture in composition to enable the roots to draw it up into the plant at a time when most needed. The soil must be so friable that when rains fall the moisture will sink and not stagnate about the roots.

For the best kind of fertilizer, and the best method of cultivation, I will refer the reader to previous bulletins issued by the experiment station.

5. The Condition of the Weather.

This factor we cannot control, but we can at least make the most of what the Creator has given us. This southern country is peculiarly adapted to the cultivation of cotton because of its sunny climate. This plant requires a warm atmosphere for its full development, and hence it produces fibre in diminished quantity and perfection in more northern than southern latitudes. The high heat of a midday summer's sun seems not to injure cotton as it does corn and other like plants. Cotton is decidedly a sun plant.

The proper supply of moisture is of equal importance with temperature. The plant will stand great heat, provided it is not growing in a very dry atmosphere, and is in

a soil that can retain moisture. According to Mallet, moisture may be supplied to the cotton plant in several ways :

1. "The atmosphere may contain a greater or less amount of water in the state of vapor up to the so-called point of saturation.

2. The atmosphere may be supersaturated, or in other words, rain may occur.

3. The soil may contain greater or less amount of water intimately united with it, whether by adhesion or in chemical combination, such water as is rapidly absorbed from the air by dried soil and can only be expelled by high temperature. This water does not render the soil moist to the touch.

4. The soil may be supersaturated and rendered moist or wet. The larger amount of water that is taken by the cotton plant in the first (atmospheric vapor) and third ways (soil water absorbed from the air under ordinary conditions), and the smaller amount that it receives in the second (rain) and fourth ways (saturated soil) the more favorable will be the result. In water soaked soil cotton will not thrive. It scalds and looks sickly. In the early stages of its growth the plant receives with advantage a moderate supply of moisture in the form of rain (water in the second condition), but even then *heavy rains are injurious*, and later in the season *they are absolutely destructive* ; the bolls do not open but fall or rot on the branches ; a surface growth of weeds and grass accumulates so rapidly as to choke the crop ; the boll worm and other insects appear in great numbers, and the crop is considerably cut off. Dry years are emphatically those of the largest and best crops."

In a dry season, when the supply of moisture has been moderate, and the plant is young and vigorous, the tap root penetrates to great depth where the supply of soil water is not so much under the control of periodical or ordinary atmospheric changes. The plant is, therefore, enabled to withstand a long drought; and if the moisture from the atmosphere has been given in small quantities all along its growth, the fibre becomes long, even and soft, the bolls open wide and the fleecy staple hangs in long, silken folds from them. Much rain and rapid growth of grass in May and June prevent the full development of the tap root and encourage a great multiplication of surface roots ; and as soon as the hot, dry atmosphere of July and August sweep across the fields the plants wither and shed because there is little tap root to bring up moisture from below the surface of the soil.

## *Table Showing Results of Microscopical Examination of Cotton Fibre.*

| Number. | Name of Variety. | How Fertilized. | Four tests on strain required to rupture two strands, expressed in grammes.* | | | | Average strain to rupture. | Width of fibre expressed in millimeters.* | Four tests to determine the length of fibre expressed in millimeters.* | | | | Average length of fibre expressed in millimeters.* | Character of Twist. | Number of seeds per boll. | Weight of seed in one boll, expressed in grammes.* | Weight of fibre in one boll, expressed in grammes.* | Per cent. of seed to one boll. | Per cent. of fibre to one boll. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Peerless,, | Not fertilized | 9.498 | 19.057 | 21.404 | 11.635 | 15.398 | 0.009 to | 22.4 | 24 | 23.2 | 24.8 | 23.6 m.m | Poor. | .... | ..... | ..... | .... | .... |
| 2 | " blighted | Floats | § | § | § | § | ..... | 0.008 " | 22.4 | 21.6 | 22.4 | 21.2 | 23 4 " | Poor | .... | ..... | ..... | .... | .... |
| 3 | " . | Not fertiiized | 27.475 | 33.915 | 29.000 | 45.176 | 33.891 | .... | 25.6 | 20.0 | 23.2 | 22.4 | 22 8 " | Average | .... | ..... | ..... | .... | .... |
| 4 | " . | Floats and C. S. M. | 29.151 | 23.652 | 21.061 | 26.719 | 25.145 | .... | 17.6 | 21.6 | 21.6 | 21 6 | 20 6 " | Medium | .... | ..... | ..... | .... | .... |
| 5 | " blighted | Floats and C. S. M. | 13.990 | 5.620 | 11.237 | 13.000 | 10.962 | .... | .... | .... | .... | .... | 20.2 " | Poor. | .... | ..... | ..... | .... | .... |
| 6 | Peerless | 200 lbs. cotton seed | 23,142 | 20.552 | 28.044 | 11.623 | 20.840 | 0.016 " | 20.8 | 18 8 | 18.4 | 18.0 | 18 5 " | Average | 42 | 3 217 | 1.751 | 64.8 | 35.2 |
| 7 | Welborn's Pet | meal and 200 lbs. | 12.258 | 15.850 | 15.902 | 11.430 | 13 860 | 0.016 " | 21.6 | 23.2 | 21.2 | 22.4 | 22 1 " | Average. | 34 | 1.312 | 0.890 | 59 .6 | 40.4 |
| 8 | Truitt | acid phosphate, | 35.437 | 28.472 | 36.856 | 20.525 | 30.322 | 0.016 " | 22.4 | 22 0 | 21.4 | 21.6 | 21 8 " | Excellent | 33 | 5 029 | 2 419 | 67 .6 | 32.4 |
| 9 | Rameses | applied broad- | 25.566 | 28.702 | 29.212 | 25.558 | 26.758 | 0.019 " | 20.8 | 17.6 | 21 | 20.8 | 20 1 " | Excellent | 34 | 2 417 | 1 029 | 70.2 | 29 .8 |
| 10 | Cherry's Cluster | cast 1,000 pounds | 55.216 | 18.695 | 38.690 | 25.310 | 29.477 | 0.019 " | 23.2 | 22.4 | 23.2 | 20.8 | 22 4 " | Excellent | 42 | 3 917 | 2 190 | 64 .2 | 35 .8 |
| 11 | Okra Leaf | per acre | 17.933 | 18.470 | 10.471 | 10.088 | 14 240 | 0.016 " | 31.2 | 33.6 | 28.8 | 28 | 30 4 " | Poor | 31 | 2 852 | 1 857 | 60 .6 | 39.4 |
| 12 | Hawkins' Improved | | 12.446 | 2.991 | 10.710 | 8.333 | 8 620 | 0.008 " | 19.2 | 16.0 | 18.4 | 16.8 | 17 6 " | Poor. | 41 | 1.670 | 1 060 | 61 .2 | 38 .8 |
| 13 | Allen's Long Staple | 200 lbs. cotton seed | 17.353 | 14.539 | 15.516 | 23.975 | 17 845 | 0.016 " | 26.4 | 25 6 | 26.4 | 27.2 | 26 4 " | Inferior | 45 | 3 722 | 2 035 | 64 .7 | 35 .3 |
| 14 | Jones' Improved | meal, 200 pounds | 23.083 | 15.323 | 25.448 | 20.900 | 23 338 | 0.016 " | 22.4 | 22 4 | 23.2 | 23.2 | 22 8 " | Medium. | 30 | 4 570 | 2.740 | 62 .6 | 37 .4 |
| 15 | Zellner | acid phosphate, | 20.130 | 28.106 | 26.345 | 15.644 | 22 556 | 0.016 " | 20.6 | 21.6 | 23.2 | 23.2 | 22 4 " | Good | 33 | 5 015 | 1.837 | 73 .2 | 26 .8 |
| 16 | Barnett's Short Staple | applied 200 lbs. | 10.960 | 10 370 | 12.050 | 8.363 | 10 436 | 0.016 " | 22.8 | 24.2 | 23,2 | 24 8 | 23 4 " | Poor | 27 | 3 115 | 1 737 | 64 .2 | 35 .8 |
| 17 | King's Improved Prolific | per acre | 15.720 | 12.996 | 16.490 | 18.100 | 15 826 | 0.012 " | 17.6 | 20.0 | 15.6 | 20.0 | 18 3 " | Good | 45 | 2 490 | 1 530 | 61 .4 | 38 .6 |
| 18 | Ellsworth | | 20.330 | 22.050 | 20 685 | 20.838 | 20 976 | 0.012 " | 21.6 | 21.6 | 21.2 | 20.0 | 21 1 " | Good. | 35 | 2 625 | 1 561 | 62 .8 | 37 .2 |
| 19 | Georgia Ordinary Upland | Not known | 19.038 | 17.597 | 21.965 | 13.650 | 18 083 | 0.012 " | 0 016 | ‡ | ‡ | ‡ | ‡ | ..... | Medium | ..... | ..... | ..... | ..... | ..... |
| 20 | Peterkin | 1,000 lbs. compost | 20.757 | 14.438 | 11.490 | 20.649 | 16 834 | 0.008 " | 0 016 | 22.0 | 25.2 | 23.2 | 22.4 | 23 2 " | Medium | 45 | 3.826 | 2 499 | 60 .5 | 39 .5 |
| 21 | Southern Hope | per acre.. | 13.363 | 21.453 | 29.903 | 22.928 | 21 912 | 0.016 " | 0 020 | 27.2 | 23.2 | 23.2 | 24.0 | 24 4 " | Good. | 40 | 4 975 | 2 239 | 68 .1 | 31 .9 |
| 22 | Bailey | Not known | 18.683 | 15.413 | 12.066 | 18.687 | 16.212 | .... | 0 019 | ‡ | ‡ | ‡ | ‡ | ..... | Poor | ..... | ..... | ..... | ..... | ..... |
| 23 | Sample from Coffee Sp'gs Ala | " | 14.303 | 24.556 | 25 173 | 17.500 | 20 383 | .... | 0 024 | 21.6 | 16.8 | 19.2 | 20.8 | 19 6 " | Medium.. | † | † | † | † | † |
| 24 | Sea Island No. 1 | " | 16.462 | 23,726 | 16.968 | 17.251 | 18 602 | .... | 0 016 | ‡ | ‡ | ‡ | ‡ | ..... | Average | ..... | ..... | ..... | ..... | ..... |
| 25 | Sea Island No. 2 | " | 17.447 | 12.156 | 14.356 | 18.352 | 15.578 | 0.016 " | 0 024 | ‡ | ‡ | ‡ | ‡ | ..... | Poor to averg'e | ..... | ..... | ..... | ..... | ..... |

* 1 Gramme is equivalent to 15.43 grains, and 1 millimeter is equivalent to 0.039 of an inch. † Cotton was received extracted from the boll. ‡ Cotton received was ginned. § Differs but little from above.

From the foregoing it may be concluded that:

The strongest cotton fibre was produced by Truitt.

The largest fibre was produced by Barnett.

The smallest fibre was produced by No. 1, Hawkin's Improved and Peterkin.

The longest fibre was produced by Okra Leaf.

The shortest fibre was produced by No. 2.

The best twisted fibres were produced by Truitt, Rameses, and Cherry's Cluster.

The largest percentage of fibre per boll was produced by Welborn's Pet, Okra Leaf, Peterkin, Hawkin's Improved, King's Improved, and in the order named.

The largest percentage of seed per boll was produced by Zellner, Rameses, Southern Hope, Truitt, and in order named.

The best grade of cotton, taking all things into consideration, is Cherry's Cluster. The second best grade is Truitt.

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## Description of Plates.

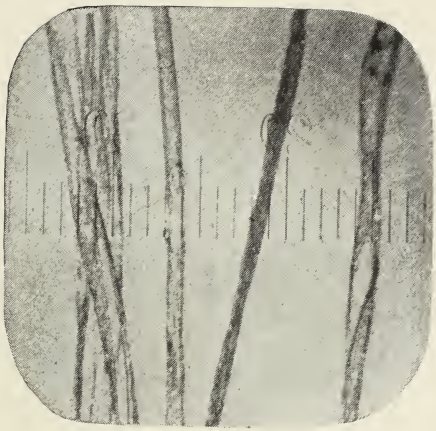
The illustrations representing the longitudinal views of the cotton are given in order to show the *twist of the fibre*, and to indicate the relative sizes of the different strands. The measurements shown in the cuts are photographs made with Zeiss' ocular micrometer. These photographs were made with Bausch & Lomb's professional photo-micro camera, fitted with Zeiss' objective (0.30 aperture and 16 m. m. focus) and compensated ocular 6, with micrometer. For the correct diameters of the fibres see the table accompanying this bulletin.

The cross sections shown in the illustration on Plate II, were magnified with Zeiss' microscope containing objective 16, and ocular 6. They were drawn by the aid of Zeiss' camera lucida (after Abbe). These sections are given to show what is known to be a well developed fibre, and one that is imperfectly formed. The well developed strand is shown by figure 4 (okra), and fig. 3 (chery's cluster), and imperfect fibres are noticed in figures 1 on the right, and also in the centre of the illustration. Figure 1 at the top of the cut is also quite immature.

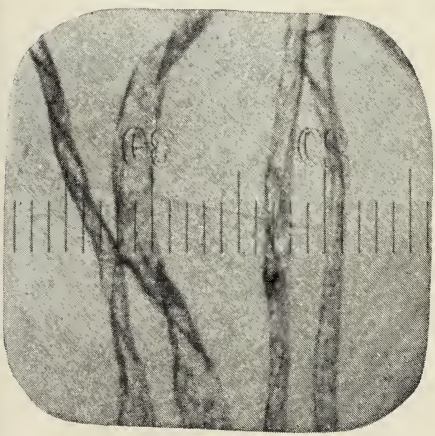
The variety Truitt, on Plate I, is decidedly the best cotton, because the strands are not only of an uniform size, but they are also remarkably well twisted. Allen's Long Staple, on Plate II, is not so satisfactory. The twist is not as good, and the strands are irregular in size—some being quite small and weak. The two cuts representing Sea Island varieties show inferior grades of cotton, weak and a decided lack of proper twist.

Each division on the scales represented in the cuts is equivalent to about 1-1600 of an inch.

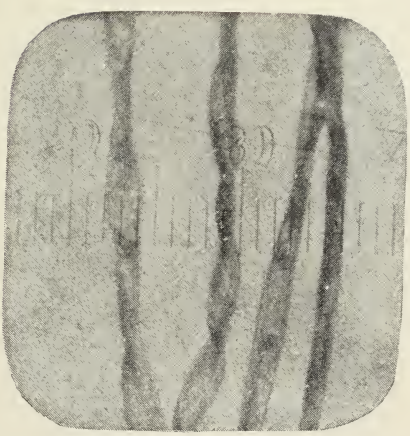
PEERLESS.



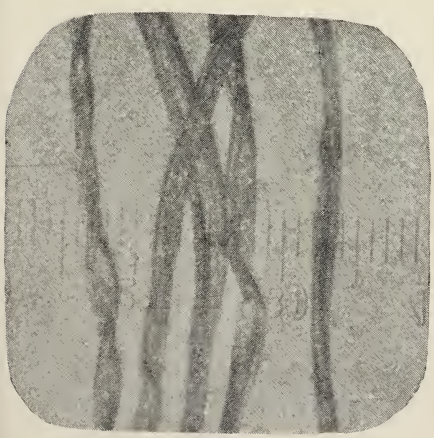
ELLSWORTH.



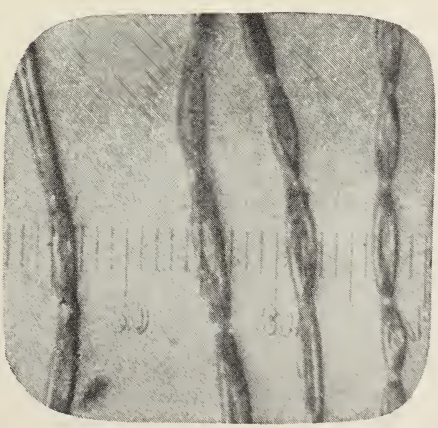
COMMON VARIETY—UNFERTILIZED.



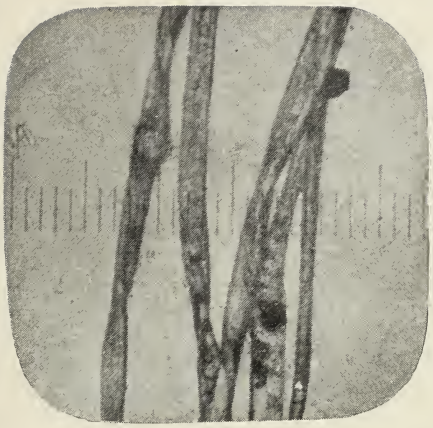
COMMON VARIETY—BLIGHTED.



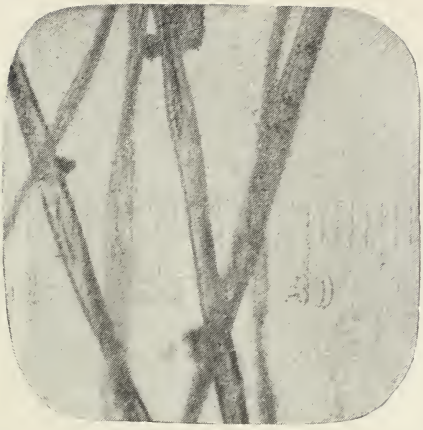
OKRA—OR FORK-LEAFED.



TRUITT.



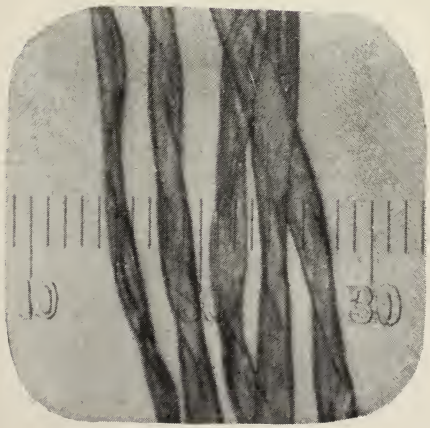
SEA ISLAND—OR FLORIDA No. 1.



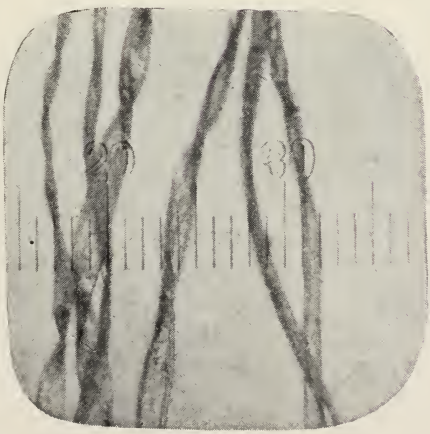
SEA ISLAND—No. 2.

CROSS-SECTIONS OF COTTON-FIBRE.

Fig. 1. Common Variety.
" 2. "Rameses."
" 3. Cherry's Cluster.
" 4. Forked-Leaf or Okra.
" 5. Peerless.



"BRANDON."



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